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# PATH-DEPENDENCY AND THE ROAD TO OFF-PATH: THE CASE OF THE FINNISH FOREST INDUSTRY

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## ABSTRACT

After many decades of growth, evolutionary innovation and acquisitions, the Finnish printing and writing paper industry finds itself mired in a deep crisis after the turn of the century. The Finnish printing and writing paper industry is a casualty of its own success, i.e., it did not realize in a timely manner that revolutionary innovation, i.e. digitalisation, challenged its business model and long term growth opportunities, and further evolutionary innovation could not solve this challenge. The problem was worsened by university programmes and an innovation ecosystem which were geared toward efficiency improvements with the help of evolutionary innovation. The drop in demand for printing and writing paper in North America and Europe has been a wake-up call for the Finnish forest industry, and the industry is attempting to reinvent itself and change its innovation ecosystem. The most significant challenge is to change the prevailing mentality and culture in the industry. The challenges the Finnish forest industry is currently facing contain important lessons for the Brazilian forest industry.

**Keywords:** Clash of Mentalities, Contracting for Innovation, Innovation Ecosystem, Revolutionary Innovation, Strategic Myopia

## INTRODUCTION

After the outbreak of the financial crisis in 2007 and the slowdown of the economic growth in Europe, including the crisis of the euro zone, the GDP in Finland dropped dramatically and the economy has been in recession for several years. This long recession cannot be explained with the decline in growth in Europe and the US, but it has several national reasons as well. Two of them are related to structural changes in the core sectors of the national business system. The first change was caused by the digital media revolution that hit the printing and writing paper industry especially in North America and Europe, where Finland-based forest industry corporations have major business operations. The second was caused by the disappearance of the mobile phone business from Nokia's business portfolio, having severe down-sizing effects in the entire Finland-based ICT cluster.

In this article we will take a look only at the Finnish forest industry.

We will particularly assess the path that led the Finnish forest industry into a long crisis period after the turn of the century and to a search for new corporate identities and roles in business constellations together with wide sets of institutional actors at multiple systemic levels. This analysis could contain also clues for forest industry companies in Brazil, as well as to actors in the Brazilian innovation system as to what kinds of initiatives are needed to prepare the sector specific innovation system to the next phase. Brazil has set the vision to be number one in global bioeconomy and is allocating considerable amount of funding for developing 2<sup>nd</sup> generation bioethanol, biochemical and biomass gasification technologies.

Brazil and Finland share a significant similarity: both have huge amount of wood resources and replicated hypes created by investments in leading edge pulp and paper mills (cf. TOIVANEN and BARBOSA LIMA-TOIVANEN, 2009). Like Finland, Brazil is experiencing economic challenges, and the drop of Brazil in the WEF ranking has been a concern in Brazil (MARTIN, 2015). Finland has kept its high ranking in the WEF evaluations, despite the structural chocks in the core sectors (*Global Competitiveness Reports*, [www.weforum.org/Reports/](http://www.weforum.org/Reports/)). This stability in the ranking is due to the high potential for the renewal of the economy in a longer term, partly based on the services provided by the welfare state. Even entrepreneurship among the younger generations is receiving high attention and engagement as demonstrated by the annual Slush events, organized in Finland and spreading to hotspots elsewhere in the world ([www.slush.org/](http://www.slush.org/)).

Thus, it makes sense to describe how and explain why the Finnish forest industry entered a path which turned out to be a wrong choice: the largest forest industry corporations chose to focus and grow particularly in the printing and writing paper segment and tried to become globally dominant companies in this segment. To do so they divested smaller business units that could have provided interesting business opportunities at the present context and disregarded inventions that were emerging in the innovation pipeline worldwide. This relates to innovative opportunities like nano and microtechnology, printed electronics, identification tags, etc. These examples demonstrate that

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there is a future for a wood- and wood fibre-based industry, but the industry will look very different in the future from what it has been.

The structure of the article is that we will first identify three drivers which pushed the leading corporations to a path that turned out to be wrong because of the digital revolution, including digital media and the rapid emergence of smartphones causing drops in the demand for printing and writing papers. The main drivers were, firstly, the mergers and acquisitions game that started in the 1980s and gained a momentum in the 1990s and early 2000s. Secondly, forest industry companies in Finland have had a tradition to focus on evolutionary innovations, with strong involvement of suppliers and sharing of technical knowhow within the engineering professions, even between competitors. Thirdly, a highly specialised university education geared towards the pulp and paper industry has been a major strength in the context of evolutionary innovations, but it has resulted in myopia as to the sources and scope of potential business opportunities.

However, within a period of ten years, the leading Finland-based forest industry companies have been able to reshape their businesses and get back to a growth path after shutting down numerous paper machines and even entire production facilities in Europe and in North America. Thus, it is also relevant to specify what kinds of obstacles there have been for innovation, how innovation could be de-iced and how does the way forward look like?

To enter into a revolutionary innovation mode does and will require a comprehensive cultural change in the printing and writing paper industry. It might be difficult or even impossible to achieve this within the old organizations in the printing and writing paper industry. Raw materials, such as wood and wood fibre will certainly attract interest from other quarters of the economy. Thus, new competition for these raw materials is already in the strategic action field. It is emerging from start-ups and companies from other industries aiming to use wood and wood fibre in innovative chemicals and materials. This is also a great opportunity for the Brazilian forest industry.

### **Drivers of the Path-Dependency in Printing and Writing Papers**

The forest industry has been at the core of Finland's industrialisation. Until the end of the 1980s, the forest industry cluster was at the core of the whole national business system. The banking system and the state were both strongly related with the forest industry cluster, both having significant ownership in forest cluster companies and providing patient capital needed for huge investments with long pay-back periods. In addition, until the end of 1950s, 80% of exports from Finland consisted of forest products. Thus, their export were the main source of foreign currency, and critical for funding imports. When business cycles caused profitability problems for the forest industry companies, the government had to intervene and push the national central bank to make devaluations of the Finnish currency

in order to re-establish the competitiveness of the forest industry companies (LILJA *et al.*, 1992). This systemic setting facilitated excessive risk-taking of the forest industry companies in Finland and formed the basis for investments in production integrates that could use the wood raw material in the most efficient way and to refine it to products that were of highest value added. Since the end of the 1960s, coated printing and writing papers were in this category and Finland-based companies were making all efforts to gain strong market positions in these products.

Since the 1920s, international sales of forest products were conducted by sales associations in which individual companies were members. This facilitated a strong presence in international markets, despite the fact that the companies were small in international comparison. When Finland joined the European Union in 1995, such organizational devices had to be abolished, because they were considered cartels by EU Competition Law. Finnish forest industry companies started preparations for this change in the late 1980s and early 1990s (HEIKKINEN, 2000). Besides investing in greenfield sites abroad, the other important strategic move was to make acquisitions of companies that had similar types of products, and by so doing facilitate the setting up of own sales operations in foreign markets. This was the start for the intra and intercontinental game in mergers and acquisitions, often labelled with the metaphor "eat or to be eaten" (MOEN and LILJA, 2001).

### **(a) Mergers and Acquisitions**

Finland's printing and writing paper industry was heavily involved in the consolidation of the European paper industry and to some degree in the consolidation of the North American paper industry in the 1980s, 1990s and the 2000s. The acquisitions were celebrated as great successes and proof of the superiority of Finland's printing and writing paper industry. A key question eluded Finland's printing and writing paper industry: Why were the sellers willing to cede their holdings? If the printing and writing paper industry was a lucrative industry with a bright future, then it would have been logical that the French, German and US sellers would have kept their holdings. But they did not.

In the decisions to sell, reasons like intra-family disputes and inheritance-related issues may have played a part, but in these cases there would have been also other options than selling the companies. This raises the spectre that the merger and acquisition spree of Finland's printing and writing paper industry was not a sign of success and superiority, but a sign of myopia, i.e., the sellers had concluded way before Finland's printing and writing paper industry that the industry was in for a rough time.

An additional dimension may have been that Finland's printing and writing paper industry has long been the core element in the Finnish national business system. The mergers and acquisitions raised Finland's flag around the world, and this was a source of pride.

Expectations of such achievements have clearly been a trigger for the expansionist sentiments among the managers.

Professional strategic management encompasses methods to counteract emotional decisions. The problem in this case was, however, that Finland's printing and writing paper industry along with the rest of Europe's and North America's printing and writing paper industry was steering toward a discontinuous change based on revolutionary technological innovation (digital media). Any strategic analysis based on past production and market data was thus irrelevant. This made the stance of strategic management difficult in the face of myopia.

### Capital Investments in Machinery

Finland's printing and writing paper industry has been known as a beacon of evolutionary technological innovation, especially since the 1950 towards the end of the 1990s, when the last new paper machines were installed in Finland. The emphasis on evolutionary innovation can be detected in the stepwise expansion and improvements of whole production integrates and in the stepwise increase of the production capacity of existing pulp and paper machines, including the increasing sophistication of process control systems.

Now, when the newest pulp and paper mills have been built in Latin America and Asia, the epicentre of evolutionary innovation has moved away from Europe and North America. Even though Finland-based suppliers have been important in the planning stage of the investments in emerging economies and in deliveries of the machinery and other technological features, there is clearly a danger that learning from such path-breaking projects do not accumulate into the Finnish forest industry cluster. This is clearly an opportunity to local suppliers in Brazil, China and India, like it was since the 1950s for Finnish companies.

### University Education

Because of the demand for engineers in the forest industry, universities of technology in Finland have paid special attention to research and education in pulp and paper technology. The very specialized Masters' programmes in paper technology have been a strength in the context of evolutionary innovation, because students have had a solid understanding of the functioning of a paper machine and its auxiliaries, and the chemical and physical issues related to paper and the production of paper. However, this has come at the expense of a broad understanding of chemical engineering and material science which are the foundation of revolutionary innovation based on wood and wood fibre.

The very specialized university programmes in paper technology have meant that engineers would have seen their knowledge in addition to their experience nullified by revolutionary innovation. This has had an unfavourable impact on the entire Finnish innovation ecosystem as it relates to the forest industry when revolutionary innovation in digital media technology undermined business models based on printed media.

### Way Forward: Obstacles to Innovation

The obstacles to innovation can be divided in two main categories both of which show aspects related to the *status quo* and mentality (psychology). First, the capital intensity of the printing and writing paper industry introduces the obstacle of sunk capital. Second, the industry mentality has not favoured revolutionary innovation.

The printing and writing paper industry is characterized by capital intensive production facilities. This poses challenges in terms of sunk costs and need of fresh capital for investments in innovative production facilities with high risk. In terms of sunk costs, companies in the printing and writing paper industry have to deal with the speed and depth of the decline in the demand for printing and writing paper, and this has forced them to take significant write-downs within a short period of time because of permanently idled production assets. These write-downs are draining the companies' financial resources to invest in innovation and the creation of intellectual property even when willingness to do so would have been there.

The production processes required for the production of innovative chemicals and/or materials may or may not require substantial capital investments at the pilot stage of the innovation pipeline. However, the uncertainty of the amount of capital investments in the full scale production phase raises already an impediment to the willingness of a company to embrace and finance R&D projects, which may lead to innovative chemicals and materials. If it turns out that substantial capital investments are required, then the perceived risks associated with an untested production technology and market acceptance require courage from the management of the company to commit to the production of an innovative chemical and/or material.

To the degree that the company has to rely on external financing or the approval by capital markets, the challenge is increased because of the poor track record of the printing and writing paper industry in revolutionary innovation. Strictly speaking, there has been only evolutionary innovations in the printing and writing paper industry after the invention of continuous paper machine by Louis-Nicolas Robert in 1798. This certainly does not make an external investor confident about the printing and writing paper industry's ability to handle all the challenges associated with revolutionary innovation.

The challenges associated with revolutionary innovation for a printing and writing paper-producing company gives rise to the question of the need to have start-ups being in charge of the activities from invention to innovation, with strong connections to universities and research institutes. Such ecosystems have been typical among start-up biotech companies and large pharmaceutical companies. For the printing and writing paper-producing companies such a setup triggers one major challenge and one major threat.

The major challenge relates to the relationship between the start-ups and the old printing and writing paper producing companies. On the one hand, the start-ups need financing, and the old companies need to decide whether to finance start-ups, and if an old company

decides to finance start-ups, then which ones to choose. Close attention needs to be paid to the financing decisions that they do not favour only evolutionary innovation and thus defeat the purpose of them, i.e., revolutionary innovation.

The major threat for the old printing and writing paper producing companies is that the start-ups grow and eventually become serious competitors for, e.g., the raw materials. In other words, a symbiotic relationship may turn into rivalry. In the biotech and pharmaceuticals ecosystem, this has happened with, e.g., Amgen becoming a serious competitor of traditional pharmaceutical companies.

Revolutionary innovation is about people, human curiosity and knowledge. Engineers and scientists engaged in revolutionary innovation will need expertise in, e.g., chemical unit operations, industrial chemistry, materials science and technology, and organic chemistry. This is not sufficient, however. It is also necessary that potential innovators are not socialized in the *status quo ante*, or at the very least they have to be able to break the grip of the *status quo ante*. This raises important organizational issues in the context of strategic management. Should revolutionary innovation be separated into a different division in a company? Or even a separate company? Or should a company choose start-ups and support financially these start-ups. All of this will require changes in the way companies are managed and what expertise is needed in the printing and writing paper industry. And it will change the competitive field to one characterized by intellectual property rights.

Revolutionary innovation will definitely have repercussions for the engineering of machinery and their controls. The printing and writing paper industry has effectively outsourced these to supplier chains. Particularly in the case of revolutionary innovation, this poses the issue of the future structure of cooperation and organization of the innovation value chain. The past and present structures are not optimal for revolutionary technological innovations that result in intellectual property rights for companies producing products from wood and wood fibres. A move towards an open innovation setting is needed.

### Way Forward: De-icing Innovation

The significant decline in the demand of printing and writing paper in North America and Europe raises the need to consider opportunities for revolutionary innovations by companies currently being engaged in the printing and writing paper business. The strategic focus would be to play the end-game phase of the existing production facilities cleverly, shift production facilities to products which have still increasing demand in the world markets, like carton board, and to do something new with the wood and wood fibre resources which the printing and writing paper industry has used hitherto. In addition, wood and wood fibres are unquestionably interesting from a chemical and physical standpoint, and they offer numerous avenues for revolutionary innovations in the realms of, e.g., chemicals, pharmaceuticals and printed electronics. However,

for revolutionary innovations the printing and writing paper industry needs people with different skill sets than for efficient day-to-day running of the paper machines.

Scientific research and invention activities potentially leading to innovation are first and foremost a function of human curiosity and creativity. Scientific research and invention activities also entail failures, but from the standpoint of innovation failures are good if they result in learning. If the printing and writing paper industry desires to embrace revolutionary innovation, then it needs to honour learning from failures. Revolutionary innovation requires thus courage as well, the courage to fail, stand up and try something else. The trait of courage is required by the researchers, inventors, innovators and the company. Courage is not only needed in dealing with failures, courage is also needed to question the *status quo*. Suggestions for moves towards revolutionary innovations will be criticized and even ridiculed by some individuals, and to withstand their cynicism innovation agents need courage.

A fundamental challenge facing companies in the printing and writing paper business is to manage the clash of mentalities (or cultures), i.e., the mentality of running a paper machine efficiently and facilitating evolutionary innovation on the one hand, and revolutionary innovation on the other hand. For creative people working on revolutionary innovation derogatory comments from defenders of the *status quo* or evolutionary innovation are demotivating and reduces the likelihood of a revolutionary innovation. Printing and writing paper producing companies need to find a way to avoid such destructive encounters.

A printing and writing paper producing company may decide to avoid the clash of mentalities by supporting and/or acquiring start-ups engaged in innovative research and inventive activities related to wood and wood fibre. Such a strategy contains two challenges for a printing and writing paper producing company. First, a printing and writing paper producing company is confronted with the challenge of identifying the most promising revolutionary innovation projects and the corresponding start-ups. If the people working on identifying them are proponents of the *status quo* or of evolutionary innovation, then the outcome will not be a revolutionary innovation.

Second, if a printing and writing paper producing company decides to acquire a start-up with the potential for valuable intellectual property rights, then the same problems as with attempts for in-house revolutionary innovation commence. In the worst case, the unofficial organization comprised of adherents of the *status quo* will effectively undermine the implementation of a revolutionary innovation by cynicism. As a general rule, the further matured the revolutionary innovation is, the lesser the intra-organizational obstacles should be, but every generalization is fraught with problems and each case has to be assessed on its own merits.

Revolutionary innovation will require a lot of courage, because the expertise of yesterday will be obsolete tomorrow. The assurance

based on past education and experience will vanish. It will not be sufficient to be good in paper technology. Entirely new expertise is required particularly in the fields of, e.g., organic chemistry, biochemistry, materials science and intellectual property law.

### Way Forward: Creating an Innovation Ecosystem

Some aspects of two organizational approaches to innovation have been discussed above: (i) Innovation within the printing and writing paper producing companies, and (ii) Innovation within start-ups. It is conceivable that existing companies with activities in another industry will engage in innovation based on wood and/or wood fibre. In addition, innovation may occur at universities, research institutes and by individuals. All of these are part of an innovation ecosystem.

Whether companies engaged in printing and writing paper business become serious contenders in the wood- and wood fibre-based innovation ecosystem is primarily a question of mentality. Is it possible to change a mentality that has developed over decades and that does not contain any exposure to revolutionary innovation? If possible, then it will be very difficult. The chances for revolutionary innovation are better, if the associated research and invention activities are undertaken in separate organizations, e.g., start-ups. The role of the printing and writing paper producing companies would be one of supporting these separate organizations and at the later stage acquire them or their capabilities and intellectual property rights and start commercializing them. However, typically such acquisitions are relevant for large forest industry companies only if the turnover potential of the start-up business is beyond 100 million dollars within the next ten years. Otherwise the top management team has difficulties to use their time to make sense of a new business context distant from the ones they have had experience and provide relevant support for the project in the innovation pipeline.

Considering the costs associated with research and invention activities, and the likelihood of failure, start-ups will need to attract people who have the courage to continue after failure, and who have the necessary creativity and engineering expertise. The start-ups will also need to attract several cycles of private equity financing in spite of the risks of setbacks and failures. One source of equity funding might be companies producing printing and writing paper, but other sources, like business angels and private equity funds, are potential providers of funding as well. A potential danger is that printing and writing paper producing companies will not be revolutionary enough in their mentality to support start-ups working on revolutionary innovations. To signal a radical change in the strategic stance and identity, a well-resourced venture division with an explicit mandate for revolutionary innovation could be a relevant solution for large forest industry companies. It is obvious that the market capitalization of such companies is very much influenced of the intellectual property rights which are in their innovation portfolio.

Besides start-ups, the new ecosystem hosts already well-resourced

companies from other industries, interested in the potential which wood and wood fibres provide for them as customers. They are engaged in research and invention activities alone, together with the large forest industry companies or together with start-ups. These large companies outside the paper industry would have good chances to introduce revolutionary innovations in a wood- and wood fibre-based value chains. Some potential candidates are biotechnology companies, pharmaceuticals, chemical companies and companies producing materials. In fact, there are already wide-scale international initiatives for getting companies together. For instance, the EU Commission's DG Research has set up a private-public partnership (PPP) for supporting innovations in bio-based economy under the Horizon 2020 program. This has collected together large amount on companies to explore opportunities for cooperation in R&D. ([www.bridge2020.eu/](http://www.bridge2020.eu/)).

The challenge with universities, research institutes and individual researchers is that although they may be able to undertake the research and invention activities, they probably do not have the capabilities to commercially exploit the results of their activities. They would either need to establish start-ups, or they would need to sell their intellectual and creative capacity and enter into co-creation projects with aims to come up with new inventions and intellectual property rights.

Because of vertical disintegration and complex inter-firm relations a new form of contracting between firms is needed, as suggested by GILSON *et al.* (2008). They have labelled such contracts made in open innovation settings with the term "contracting for innovation". Such a contract pays special attention to the continuous uncertainty that shadows exploratory initiatives in a multi-actor context and provides contractual tools for handling unprecedented situations and the costs of contracting. It is invigorating to know that such contracts are already in use.

Although there is nothing completely new in the ecosystem outlined above, i.e., different aspects thereof have been used in other industries, the route to off-path for the printing and writing paper companies means that, without doubt, there is a need to expand and intensify the innovation ecosystem based on wood and wood fibre.

### CONCLUSION AND OUTLOOK

Finland's printing and writing paper industry was successful for half a century during several phases of growth and decline in the global economy, but this very success resulted in the emergence of myopia (cf. LEVINTHAL and MARCH, 1993). This myopia meant an adherence to a business and technological paradigm which unexpectedly became challenged by the digital revolution and opportunities for revolutionary innovation were not explored. This myopia was not only an issue of top management, it was also an issue deep within the organizations. The former success perpetuated the myopia within the organizations, and it was strengthened by the specialized university programmes in Finland.

In order to survive and maybe even thrive in the future, the wood- and wood fibre-based industry needs to embrace opportunities for revolutionary innovation. Because this means that competition will be based on new capabilities and intellectual property rights rather than the factors relevant in the past, the companies will need to embrace new sets of expertise. The organizational settings will also have to be reconsidered, e.g., should initiatives for revolutionary innovations be insourced, should they be explored together with potential large customers embedded in other industries or should they be done in small start-ups or is a wider set of actors needed, including research institutes and universities?

For large forest industry companies it will be very difficult, maybe even impossible, to change organizational cultures geared toward day-to-day operations and at the very most towards evolutionary innovations into generators of revolutionary innovations. If companies attempt to do work related to revolutionary innovation intra-organizationally, then they may need to protect this work by establishing an autonomous division. This is needed to protect the individuals and groups associated with the work from the rest of the organization in order to avoid their demotivation.

It is likely that much if not all of the work related to revolutionary innovation will take place outside of the printing and writing paper producing companies. If the printing and writing paper producing companies desire to take advantage of the work of these external entities, then they will need expertise on issues of which they have little or no expertise currently, e.g., assessing the potential for

revolutionary innovation and making use of the intellectual property law and new forms of contacting for innovations.

Start-ups and companies from other industries exploring revolutionary innovation based on wood and wood fibre will probably hold the keys to innovative value-added chemicals and materials. The emergence of innovative chemicals and materials based on wood and wood fibre will change the wood-based value chains. The question for the printing and writing paper industry particularly in Europe and North America is whether it shrinks into obscurity or embraces revolutionary innovation and thrives in the future.

For Brazil, this experience from Finland provides strategic insights. It is not enough to be in the epicentre in investments for pulp and paper production lines, even though such investments create the need to secure the renewal of forest resources, set up the logistical chains for wood materials and final products for deliveries, get local companies to be involved in the supply chains for technologies and services needed in the production processes and set up leading edge educational programs for engineers to work in pulp and paper mills. There is a need to orientate toward new inventions that are in the pipeline in chemistry, physics and electronics and which will have revolutionary implications for the use of wood and wood fibre. The most important lesson from the experience of the Finnish forest industry is that it is strategically very risky to concentrate and rely only on an innovation ecosystem geared toward evolutionary innovation. In a world characterized by rapid unexpected revolutionary innovation, evolutionary innovation may be rendered obsolete. ■

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